Superconductor Interactions With Gravity

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NASA's Advanced Space Transportation Program (ASTP) is charged to investigate technologies and concepts which will result in future reductions in the cost of space travel. The program has established an area of investigation in breakthrough propulsion physics. These basic investigations focus on ideas which are beyond our present capability to implement, yet offer some theoretical or experimental basis to warrant further research.

One of these areas involves the possible gravitomagnetic effects of high-speed rotating superconductors in strong magnetic fields. Published reports[1] indicate a possible gravity shielding effect with such an apparatus. Podkletnov devised an experiment in which a large disk of high-temperature ceramic superconducting material was magnetically levitated and rotated at high speed (up to several thousand r/min) in the presence of an external magnetic field. In the course of the tests he noted that objects above the rotating disk showed a variable but measurable loss in weight (variable from less than 0.5 to around 2 percent). He had no explanation for this effect and went through a self-described rigorous effort to eliminate systematic or other possible sources of error. Having done so, he found that the effect remained. The effect, while small, offers significant potential for propulsion, if real.

Dr. Ning Li, University of Alabama in Huntsville (UAH), has established a theory which establishes a theoretical basis for such gravity-superconductor interactions.[2,3,4] Based upon the reported experimental data and the Li theory, MSFC and UAH are preparing a cooperative experiment to determine, with scientifically supportable rigor, whether the reported effect is real and measurable.

The test apparatus consists of a disk of high-temperature superconducting ceramic (YBCuO material) levitating and rotating in a magnetic field. Measurements will be taken of the local gravity field surrounding the disk before, during, and after operation. Several independent methods will be used to monitor the gravity field. As the properties of this material are highly variable and very dependent upon processing, considerable effort will be expended characterizing both the superconducting material and disk processing.

[1]Podkletnov, E.; Niemanen, R.: "A Possibility of Gravitational Force Shielding by Bulk YBa2Cu3O7-x Superconductor." Physica C 203, pp. 441–444, 1992.

[2]Li, N.; Torr, D.G.: "Effects of a Gravitomagnetic Field on Pure Superconductors." Physical Review D, pp. 457–459, 1991.

[3]Li, N.; Torr, D.G.: "Gravitational Effects on the Magnetic Attenuation of Superconductors." Physical Review B, vol. 46, no. 9, pp. 5489–5495, 1992.

[4]Torr, D.G.; Li, N.: "Gravito-electric Coupling via Superconductivity." Foundation of Physics letters, vol. 6, no. 4, pp. 371–383, 1993.

Sponsor: Advanced Space Transportation Program; Center Director's Discretionary Fund

University Involvement: University of Alabama in Huntsville

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